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ABSTRACT

The overwhelming majority of research on environmental influences has concentrated on the social environment, to the relative neglect of the physical environment. This neglect is justified by an unvalidated hypothesis, namely that the physical environment must be mediated by social parameters in order to influence development. Two studies were conducted to test that hypothesis. Subjects in both studies were 12-month-old infants. Physical and social environment codes, based on direct home observation, were taken from the Purdue Home Stimulation Inventory. The outcome variable of the first study was that of language development, while that of the second was infant mastery motivation. In both studies, hierarchical regression was used to assess whether unique predictive variance was associated with either the physical or social environments. Results indicated that when social environment codes were entered first, the physical environment codes still maintained their predictive power. In contrast, when physical environment codes were entered first, the predictive power of the social environment codes dropped to nonsignificance. These results are contrary to the hypothesis that the physical environment must be mediated by the social environment, and suggest that neglecting the study of physical environment influences cannot be justified empirically. (RH)

Comparative Salience of Physical and Social Environmental Influences

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Comparative Salience of Physical and Social Environmental Influences

Recent theoretical reviews (Bronfenbrenner, 1979; Wohlwill, 1983) clearly indicate that the environment is not unitary but rather is highly differentiated, containing a variety of specific subunits or levels. In studying the role of the environment upon development, the overwhelming majority of evidence has been at the most molecular of these levels, corresponding to what Bronfenbrenner has called the microsystem. Traditionally, the study of microsystem influences has most often involved investigation of the relevance to development of transactions between children and caregivers - the social environment (Wachs & Gruen, 1982; Wohlwill, 1983). While microsystem influences have been most often equated with social environmental influences, the social environment does not completely define the microsystem. There is at least one other major aspect of the microsystem, namely the physical environment. The physical environment has been traditionally defined as the stage or setting upon which social transactions take place (Wohlwill, 1983).

In the study of environmental influences upon development there has been a general neglect of the potential influences of setting factors (Wachs & Gruen, 1982). This neglect is justified by the prevalent assumption in the field that variability in children's behavior is basically due to social environmental influences. Within this framework it is further assumed that the physical environment can have little impact upon development, unless mediated by the social environment (Clark-Stewart, 1973; Parke, 1978; Provence and Lipton, 1962). For example, in his review of social environmental influences, Parke (1978, p. 35) has noted: "the

physical world, in short, is very often socially mediated by parents or by other social agents in the child's environment". This assumption of the primacy of the social environment has been generally accepted in spite of the fact, as noted by McPhee, Ramey and Yeates, (1984 p. 346-347) that the data to support this assumption are: "sparse and somewhat contradictory".

Not only is there little data in developmental psychology supporting this prevailing assumption, but evidence from other domains, such as cross-cultural psychology, suggests the converse; namely that it is the physical environment which may mediate the salience of the social environment. (McSwain, 1981; Woodson & deCosta-Woodson, 1984). For example, McSwain (1981) has noted that the presence of sharp limestone formations on islands in New Guinea typically result in severe parental restrictions on infants exploratory behavior, as opposed to island cultures where such formations do not exist and which are typically more tolerant or supportive of the child's exploratory behavior.

In contrast to the prevailing assumption about the pre-eminence of the social environment, there are, in fact, at least three potential models of environmental action defining the relative salience of physical versus social environmental influences. These are shown in Figure 1.

Insert Figure 1 about here

Model 1 hypothesizes a relative independence of social and physical environmental influences, with both being equally relevant for development, and neither being dependent upon the other. Model 2

reflects the traditional view in developmental psychology, namely that the impact of the physical environment is mediated by the social environment; within the framework of model 2 it becomes impossible to understand physical environment-development relations without taking the social environment into account. Model 3, derived from cross-cultural studies, suggest the converse, namely that it is the physical environment which mediates the social environment; within the framework of model 3 it is impossible to understand social environment-development relations without taking into account the physical environment. The present paper describes two studies which test the viability of these three environmental action models.

Study 1

Study 1, reported by Wachs and Chan (1986), involved forty-eight twelve month old infants. The goal of the study was to look at environmental correlates of specific aspects of infant communication performance, particularly those involving use of new words and number of declaratives utilized by the child (the ability of the child to use verbal and nonverbal communication as a means to obtain adult attention). When the toddlers reached twelve months of age six home observations were done over the course of a month, with each observation encompassing forty-five minutes. To minimize the effect of the presence of an observer the first two observations were discarded and the data not used. The data from the remaining four observations were aggregated, given available evidence that aggregated observational measures provide more stable and representative measures of the child's environment (Wachs, in

press). During each forty-five minute observation the observer coded specific parent/child interactions, using codes derived from the Social Environment section of the Purdue Home Stimulation Inventory (PHSI-IV). PHSI-IV codes were chosen on the basis of their being potentially relevant to individual differences in early communication performance, and included such items as amount of spontaneous parent vocalization, the amount and characteristics of parent responses to child's vocalizations, the amount of object naming and activity highlighting by the parent, parental involvement in child activities and parental use of coercion with the child. After every 15 minutes of observation the observer stopped recording social interactions and recorded ongoing physical characteristics of the child's environment occurring over the past 15 minutes. The codes used (PHSI-III) included three measures of background noise in the home and two measures of home "traffic pattern" (number of people coming and going in the home over the past 15 minutes). At the third observation the observer coded the static physical quality of the child's home (PHSI-I-II), including measures of crowding, availability of objects, variety of visual stimulation for the child and temporal scheduling in the home.

In using this data to test models of environmental action the first stage of data analysis involved obtaining the univariate correlations between infant communication and the physical and social environmental codes. The significant physical environmental predictors were then organized into a physical environment data set, while the significant social environment predictors were organized into a social environment data set. (Given that our emphasis was on the relative salience of social versus physical environmental

predictors it made little sense to use all physical and social environmental items; this question can only be answered by comparing significant physical and social environmental predictors). The two data sets (as well as maternal verbal IQ and socioeconomic status) were entered into hierarchical regressions, as a means of testing the validity of model 2. Specifically, the social environment data set was entered before the physical environment data set in the regression. The specific question asked was whether or not the physical environment contributes unique variance to the prediction of communication performance, after the impact of the social environment has been partialled out through hierarchical regression. Model 2, if valid, would say that there should be no unique variance associated with the physical environment after the variance associated with social environmental parameters have been partialled out.

The results of this hierarchical regression are shown in Table 1. The results shown in Table 1 indicate that for both new words

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Insert Table 1 about here

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and declaratives the physical environment contributes unique variance, even after the impact of the social environment has been partialled out. This data clearly does not support the validity of model 2, nor the prevailing assumption in the field about the primacy of social environmental influences.

Study 2

Study 2 was developed as a means of dealing with certain

potential problems in interpretation of results from study 1. Specifically, even though aggregated data were used in study 1, the sample size is relatively small for multiple regression. One question that arises is whether the results in study 1 can be replicated using a larger sample. A second potential problem is whether or not the results obtained in study 1 are unique only to language; that is can the results be generalized to other functional domains. Study 2 was designed to not only determine if the results from study 1 could be replicated and generalized but also, to test the relative validity of models 1 and 3.

Subjects in study 2 were 88 infants who were 12 months of age at the start of the study. For study 2, the outcome variable was infant mastery motivation, measured in both a free play and a structured play situation. Infants mastery and non-mastery behaviors were coded using an expanded version of the mastery motivation scale codes developed by Yarrow and his colleagues at NICHD (Yarrow, et al., 1983). In the structured play situation the child is given a set of 9 toys for 3 minutes apiece, and the child's behavior with each of the toys are coded; in the free play situation a pile of toys is put on the floor in front of the child and the child's behaviors are again coded. Non-mastery codes included amount of off-task behavior, amount of passive watching of toys or persons, amount of non-mastery object interaction, and amount of distress. Mastery codes included measures of the child's motivation to master objects and to master persons (object mastery and social mastery).

The same basic observational strategy used in study 1 was again used in study 2, with 6 home observations done in the month after

the child reached 12 months of age, the first 2 observations being discarded and the data being aggregated from the last 4 observations. Given that one of our goals was to look at environmental correlates for mastery motivation, somewhat different PHSI-IV social codes were used, with codes chosen on the basis of their potential salience for mastery behavior. There was overlap for items coding amount of parent vocalization; contingency of parental response to child's vocalization and parental involvement; in addition new social interaction codes included measures of amount of physical contact with the child, degree of parental interference with the child's ongoing actions and amount of parent giving, showing or demonstrating objects.

The same data analysis strategy was again used, starting with univariate correlations and combining the significant physical and social environmental correlates into data sets. To maximize comparability with study 1 we used for criterion variable only those mastery codes where there were multiple significant univariate physical and social environmental predictors. Four mastery codes met this criterion of having multiple physical and social environmental univariate predictors (off-task behavior in the structured situation, object mastery in the structured situation, passive object watching in the free play situation and person mastery in the free play situation). As in study 1 hierarchical regression was utilized, first entering the social and then the physical environmental data set to see if the results of study 1 could be replicated. To test models 1 and 3 the hierarchical regressions were then rerun, entering the physical environment data

set first followed by the social environment data set. If model 1 is valid than order of entry should make no difference, with both physical and social environmental data sets accounting for unique predictive variance. If model 3 is correct then the variance due to social environmental factors should drop out, after the variance due to physical environmental factors has been accounted for.

The results are shown in Table 2. What our results indicate is

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Insert Table 2 about here

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that across all 4 mastery codes, when the social environment is entered first, the physical environment continues to contribute unique variance. This replicates the results of study 1, and casts further doubt on the validity of model 2 and the prevailing assumption about the primacy of social environmental influences. When the physical environment data is set entered first, across all 4 outcome variables variance associated with the social environment drops to nonsignificance. These results do not support the validity of model 1 (independent influences), but do support the validity of model 3 (physical mediates social).

It could be argued that these unique results for study 2 are due to the fact that only 4 out of 16 mastery codes were used. To test this possibility, for the remaining 12 codes individual physical and social environmental predictors were entered together in separate regressions. The results indicated that for 6 out of the 12 mastery codes unique variance was associated only with physical environmental items; for 3 out of the 12 codes unique variance was associated only with social environmental items, and for the

remaining 3 codes unique variance was associated with neither physical or social environmental items. These results again offer greater support for the validity of model 3 than for that of models 1 or 2.

The Nature of Physical Environmental Mediation

The data reported above indicate that, contrary to what is commonly assumed, the physical environment acts to mediate the impact of the social environment and not the converse. Given this, it is relevant to ask what aspects of the physical environment are most relevant in mediating the impact of social environmental influences upon development. The data from two studies are particularly relevant here.

As a means of answering the question about which dimensions of the physical environment are most likely to act as mediators of the social environment the physical and social environmental items used in study 2 were intercorrelated. Thirty-three percent of the correlations in the matrix were statistically significant. To eliminate random relations, and interpret only the most consistent physical environmental predictors the cutting-score procedure was applied to this matrix. In the cutting score procedure the mean number of significant correlations for PHSI physical environment items, as well as the standard deviation of this distribution are obtained. This combination of mean plus standard deviation forms the cutting-score. In terms of interpretating data only those physical environmental parameters which have significant correlations with the social environment at or above the cutting-score of mean plus standard deviation are accepted. For example, in

the study 2 data, the mean number of significant correlations per PHSI physical environment item was 2.94, and the standard deviation was 2.04. This rounds to a cut-off score of 5. Thus, for interpretation, only those PHSI physical environment items which had 5 or more significant correlations with the social environment were used. Four items met this criteria.

The 4 PHSI physical environment items meeting the cut-off score criteria are shown in Table 3. The results show a highly consistent

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Insert Table 3 about here

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pattern. Specifically, the data from Table 3 indicate that high levels of crowding, background noise and home "traffic pattern" are the most consistent predictors of the social environment. These items are conceptually related, in terms of being not only background rather than focal, but also having what Gibson (1982) would call low affordance value - that is the items allow little fit between their stimulus properties and behaviors which would naturally be associated with these stimulus properties. The results in Table 3 indicate that these items appear to mediate the social environment through high levels of noise, crowding or traffic pattern being associated with lower levels of social environment items that have been previously demonstrated to facilitate development (i.e., noise is associated with lower parental investment in the child's activities, lower spontaneous vocalization, responsitivity to the child's vocalizations), as well as with higher levels of social environmental parameters that have been previously demonstrated to negatively influence development

(ie., high levels of crowding are associated with more interference with the child's actions and more nonresponsivity to the child's vocalization).

To test the generalizability of the above findings, data were reanalyzed from an earlier study (Wachs & Gandour, 1983), involving 100 infants who were 6 months of age. In this earlier study the physical environment codes were those from the PHSI; however, the eleven social environment codes were taken from the social interaction scale developed by Yarrow (Yarrow, Rubenstein & Pedersen, 1975). The intercorrelations between the physical and social environmental items were again computed and the cutting score procedure was applied. The cutting score obtained for this data set was 3; results indicated that 3 physical environmental items met this criteria. These data are shown in Table 4. In general, the

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Insert Table 4 About Here

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reanalysis, using younger infants and a different set of social environment parameters are quite consistent with the 12 month data. Specifically, measures of noise and crowding are related at 6 months to social interactions between caregiver and infant in the same way that they are at 12 months. (While rooms to people ratio is unique at 6 months, it is worth noting that this measure just missed the cut-off score at 12 months - 4 significant correlations - and the direction of results at 12 months was the same as at 6 months). Thus, the data from two studies indicates that background, low affordance physical environmental items appear to mediate the impact

of social environment upon development, through interference with positive aspects of the social environment and facilitation of negative aspects.

Conclusions

The data reported above clearly indicates that the prevalent assumption in the field on the primacy of social environment influences over the physical environment is incorrect. Physical environmental parameters do not need to be mediated by social environment in order to have an impact upon development. Rather, the converse appears to be true. It would be tempting to conclude from these results that social environment is not really relevant for development, unless physical environmental parameters are simultaneously considered. However, I feel this conclusion is a bit radical at present. I think the more conservative conclusion, which I have no hesitancy in putting forward, is that these data indicate that much more emphasis needs to be placed on setting influences, both in developing environmental action theories and in studying the role of environment upon development.

Part of my caution at this point has to do with the possibility of potential alternative explanations for the above results. Two explanations are particularly critical and will be dealt with by my research group in future years. The first has to do with the potential mediating impact of macroenvironmental influences (Bronfenbrenner, 1979) upon the microenvironment. Specifically, it is possible that there may be non-microenvironmental influences. which are associated with both physical and social environment, and that mediate both of these.

One obvious macroenvironmental influence would be socioeconomic

demographic factors. However, I tend to reject this explanation, given the fact that sociodemographic factors showed little relevance to outcome in study 1; in study 2 our results indicate that measures of mid parent educational level were generally unrelated to outcome. Hence, I think it is difficult to justify sociodemographic factors as mediators.

Potentially more likely are factors such as parental characteristics, marital quality or non-family environmental factors. It could be hypothesized, for example, that parents who are high in ego integrity might be more likely to provide more adequate physical environments and more adequate social transactions for their infants. In this case parent characteristics could act as a mediator. Similarly, it could be argued that level of marital quality between the parents could mediate these relations, with infants in maritally disruptive homes being exposed to more detrimental background stimulation and less adequate social transaction. Finally, non-family factors like the balance between amount of family stress and social support available to the parents could also act to mediate these relations, where parents having more stress and less support providing more inadequate physical and social environments for their infants. These possibilities will be tested over the course of the next year in a study done to be done by myself and, (Ozlem Camli) one of my graduate students.

A second alternative, which is theoretically quite exciting, is based on a model developed by Wohlwill (1983). Wohlwill has hypothesized that there may be a developmental trend in the nature of the relation between the physical and social environments.

Wohlwill's basic premise is that the immature child is a captive audience, who can not avoid over-stimulation or seek out positive stimulation by itself. However, over time as the child becomes more mobile, it has the potential to increase it's control of the environment, either through selection of environmental niches or through directly altering the environment. Thus, Wohlwill hypothesizes a three stage process wherein, over time, the mediating impact of the physical environment upon the social may become lessened. Specifically, over time we may see a shift from results supporting model 3 to those supporting model 1. A pattern of this type would be theoretically important, not only in terms of supporting Wohlwill's model, but also in terms of offering a mechanism for what I have called the "hypothesis of age specificity" - different aspects of the environment are relevant for development at different ages (Wachs & Gruen, 1982). I hope in the near future to begin to test this hypothesis, through a longitudinal follow up of the comparative salience of physical and social environments upon infant's development across the first few years of life.

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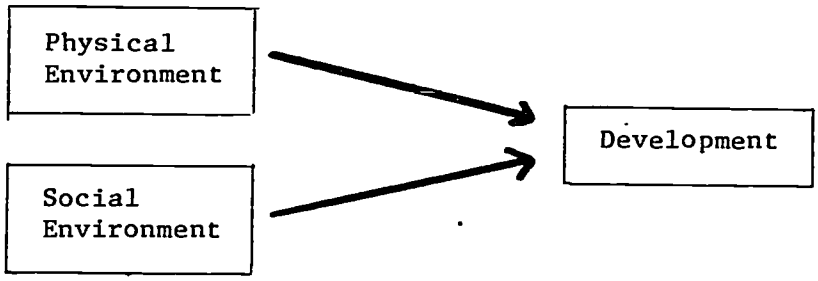
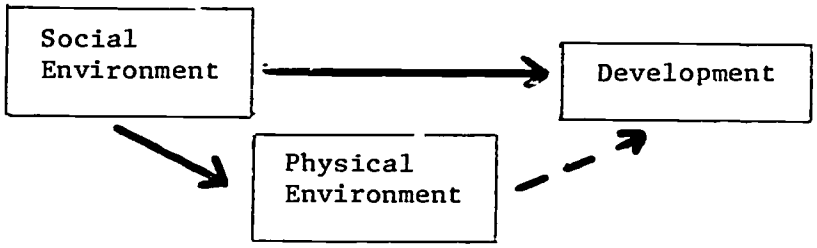
FIGURE 1.

Models of Physical Environment Action

Model I. Independent Effects



Model II. Social Mediates Physical



Model III. Physical Mediates Social

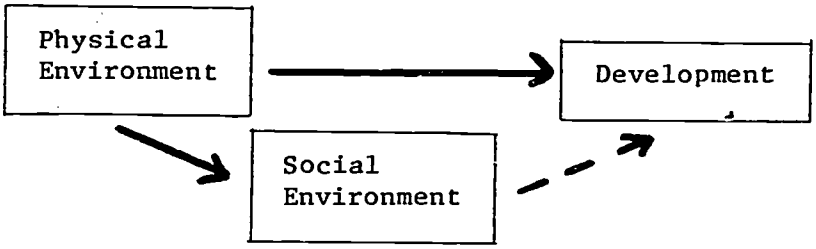


TABLE 1.

Maternal Verbal IQ, Social Environment, Physical Environment, SES and 12 Months Communication Level

New Words

R = .82	F = 6.08	(df = 12/35)	p < .01
Order of entry		sR^2	F
1 Maternal verbal level		.01	.55 ns
2 PHSI IV item data set		.25	2.86*
3 PHSI I-III item data set		.32	5.51**
4 SES		.09	10.23**

Declaratives

R = .79	F = 3.68	(df = 12/32)	p < .01
Order of entry		sR^2	F
1 Maternal verbal level		.05	2.38 ns
2 PHSI IV item data set		.43	3.91**
3 PHSI I-III item data set		.15	2.69*
4 SES		.01	.35 ns

* $p < .05$

** $p < .01$

TABLE 2.

Data Set Regressions

Multiple indices of both Physical and social environmental predictors

Code	R	Entered First	Entered Second	sR^2 for Second Entry
SP0	.36**	Social environment	Physical environment	.096**
		Physical environment	Social environment	.004 ns
SP3	.35**	Social environment	Physical environment	.061*
		Physical environment	Social environment	.023 ns
FP1	.39**	Social environment	Physical environment	.116**
		Physical environment	Social environment	.034 ns
FP6	.22*	Social environment	Physical environment	.49**
		Physical environment	Social environment	.000 ns

** $p < .01$ ns = Non-significant

* $p < .05$

TABLE 3.

HISI Physical Environment codes having 5 or more significant correlates with HISI social environment codes.

Physical Environment Code	Social Environmental Code	r
SLS (# sibs)	Level parent investment	-.27**
	Amt spontaneous voc.	-.32**
	Amt object naming	-.26**
	Amt labeling ongoing activity	-.18*
	Amt non-resp to child voc	.24*
	Amt non-verb resp to voc	.20*
	Amt interfere with actions	.38**
SL4a (TV on time)	Level parent investment	-.28**
	Amt spontaneous voc	-.31**
	Amt object naming	-.18*
	Amt show, give, demonstrate	-.28**
	Amt interfere with actions	.21*
SL5 (Noise rating)	Level parent investment	-.22*
	Amt spontaneous voc	-.32**
	Amt object naming	-.18*
	Amt non-resp to child voc	.25**
	Amt interfere with actions	.30**
SL7 (# persons in home during obs - "traffic pattern")	Level parent investment	-.32**
	Amt spontaneous voc	-.25**
	Amt object naming	-.22*
	Amt show, give, demonstrate	-.18*
	Amt non-response to child voc	.24**
	Amt tactual-kinesthetic stim	.21*

** $p < .01$; * $p < .05$

TABLE 4.

	PHSI Codes		
Yarrow Scale Codes	*Noise Rating*	*Number of Siblings (Crowding)*	*Number of Rooms in Home/Number of People at Home (Crowding)*
Visual stimulation			
Auditory stimulation	−.19*	−.24**	.17*
Contingent vocalization	−.18*	−.25**	.19*
Tactile stimulation			
Kinesthetic stimulation			.16*
Smiling to baby		−.19*	
Playing with baby			−.27**
Adult social mediation with reinforcement	−.20*	−.24**	
Adult social mediation without reinforcement			−.29**
Expression of affection			
Response to distress			

*$p > .05$.
**$p > .01$.